News and Short Contributions

Special Studies

The Obsidian Trade at Isla Cerritos, Yucatán, Mexico

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Provenience analysis of a small sample of obsidian artifacts from Isla Cerritos, a Terminal Classic/Early Postclassic Itzá trading port on the north coast of Yucatán, indicates a wide range of raw material sources from Central Mexico to the Guatemalan Highlands. The overwhelming predominance of Central Mexican obsidian reinforces the notion that Isla Cerritos was the main trading port of Chichén Itzá. The analysis also provides an indirect approximation of the Itzá obsidian trade networks, which were heavily reliant on sources that may have been under the control of the Toltec capital at Tula.

Introduction

In 1984 and 1985 members of the Isla Cerritos Archaeological Project recovered 109 obsidian artifacts from Isla Cerritos and Paso del Cerro, a site on the adjoining mainland. Isla Cerritos is a small island 600 m off the north coast of Yucatán, 5 km west of the mouth of the Rio Lagartos estuary (FIGS. 1, 2). The island was settled from ca. 100 B.C. to A.C. 1200, with evidence of sporadic occupation from that time to the present. Its main period of occupation was during the Terminal Classic and Early Postclassic periods (Chacpel and Jotuto phases, ca. A.C. 750–1200). During this time it served as a major trading enclave and as the main outpost of the inland capital of Chichén Itzá (Andrews and Gallareta Negrón 1986; Andrews et al. 1988).

The obsidian sample consisted of 103 black, grey, and green prismatic blade fragments, a black and a gray waste flake, and four green beads. Ninety-five blade fragments, the waste flakes, and the beads came from surface and excavated contexts at Isla Cerritos, and eight blade fragments were recovered from the surface of Paso del Cerro. Sixty-nine of the artifacts came from dated stratigraphic contexts on the island. We did not recover any obsidian cores from the site, nor have we thus far encountered unusual densities of obsidian artifacts or wastage that would suggest the existence of a workshop area.

Thirty-four black and grey prismatic blade fragments and waste flakes, representing the majority of specimens from dated deposits, were submitted to the Lawrence Berkeley Laboratory of the University of California at Berkeley for provenience analysis. All samples were analyzed by X-ray fluorescence (XRF) and, in some cases where the results required further study, by neutron activation analysis (NAA).

Method

The elements Ba, Rb, Sr, and Zr are generally the most significant elements measured by XRF. Fe, Ce, Zn, Y, and Nb are also measured and may be used in the identification where their abundances are unusually high. In using a non-destructive procedure for XRF determinations, errors are introduced because of variation in sample size and shape. Thin artifacts measured against thicker standards tend to display abundances somewhat higher than the true values. By taking abundance ratios of elements with x-rays having nearly the same energy (e.g., Rb, Sr, Zr) this error cancels out to a large extent. The measurements are calibrated with El Chayal reference obsidian.

The abundances (Ba) or ratios (Rb, Sr, and Zr) are first

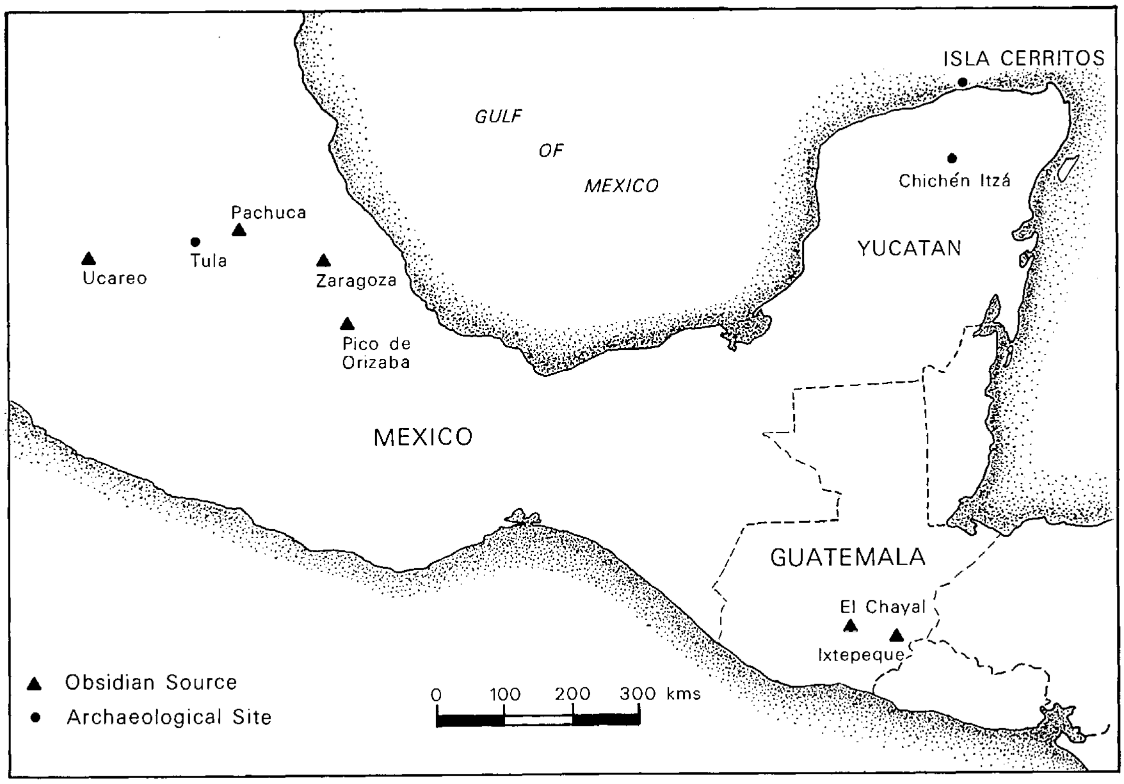

Figure 1. Map of Mesoamerica, showing the location of Isla Cerritos and its sources of obsidian.

calculated for individual samples. For each group of samples having a common provenience assignment, the mean values are then calculated. In addition, the standard deviations or root-mean-square deviations (RMSD) in these values are calculated and compared with statistical errors inherent in counting radioactivity; this permits evaluation of performance of equipment and procedures.

If the RMSD of the critical element(s) in a group is less than 10%, and no sample has abundances diverging by three standard deviations from the mean, all of the artifacts probably have the same provenience. If the RMSD for a provenience group is less than 10%, and the group is in closer than 10% agreement with a reference group, it is provisionally assigned to that reference group. A high-precision, destructive, "short" neutron activation analysis (NAA) is then made of a representative member of the group. If the abundances of elements in an artifact agree within three standard deviations of the measurements or of the RMSD of the NAA the assignment of that artifact to the reference group is confirmed. The assignments of all the artifacts in the provenience group are then also considered confirmed.

Any artifact whose XRF composition does not conform to the criteria stated is also analyzed by a "short" NAA and, if assignment still cannot be made, often by a complete NAA. If the composition does not match any of the known sources, it can be positively excluded from those sources.

In a more abbreviated NAA, the elements measured that are most significant in obsidian analysis are Mn, Dy, Na, and K. In a "complete sequence" measurement U, Ba, La, Ce, Sm, Eu, Yb, Co, Sc, Fe, Th, Cs, Rb, Hf, and Ta (as well as other chemically similar elements) are precisely determined in most obsidians. The uncertainties of the calibration standard, Standard Pottery, are the major sources of systematic uncertainty after other systematic errors, which are believed generally to be smaller than the counting errors, have been taken into account. Standard Pottery, however, is one of the very few standards in which the uncertainties are known for all the elements measured in this work. The composition of Standard Pottery, procedural details, and error estimates are described by Perlman and Asaro (1969, 1971). Additional details of the method are given in Stross et al. (1983).

Generally, if an obsidian artifact belongs to a well-defined group, the abundances of the best-measured elements (usually 14 to 16 are evaluated) in the artifacts will deviate from those of the reference group by no more than 2–3% on the average. Somewhat greater deviations may indicate inhomogeneity in the source, while significantly greater deviations normally are taken to indicate a different source.

Results

The results of the XRF analysis are presented in Table 1. Of the 34 samples, 9 were assigned to El Chayal, Guatemala; 18 to Ucareo, Michoacán, Mexico; 3 to Zaragoza, Puebla, Mexico; 2 to Ixtepeque, Jutiapa, Guatemala; 1 to Pico de Orizaba, Veracruz, Mexico; and 1 could not be assigned on the basis of the XRF measurements. The Ba values of the Ucareo samples appear to be clustering around two levels, 140 and 180, and seem to reflect a measurable heterogeneity in this element. Small differences were also detected in the Sr/Zr ratios.

Table 2 presents the results of the additional NAA measurements we made to confirm assignments made by XRF, or to make assignments that could not be made on the basis of XRF alone. Samples CERT-10 and -17 agree very well with the El Chayal reference value. As an example of the agreement, the average difference between sample CERT-17 and the reference for the best-measured elements is 1%. Samples CERT-3, -9, -14, -24, and -25 were also confirmed in their assignments to the Ucareo source. The average between one of the samples, CERT-9, and the Ucareo reference for the 14 best-measured elements is 2.1%, which is satisfactory agreement. In the NAA measurements, the variation in the Ba values is also observed as are smaller variations for La, Ce, and Eu. Heterogeneity has also been found for obsidian from Borax Lake, California (Bowman, Asaro, and Perlman 1973), and the Mullumica flow in Ecuador (Asaro, Michel, and Burger 1981). Sample CERT-19 was confirmed in its

Figure 2. Map of the Isla Cerritos Region, Yucatán.

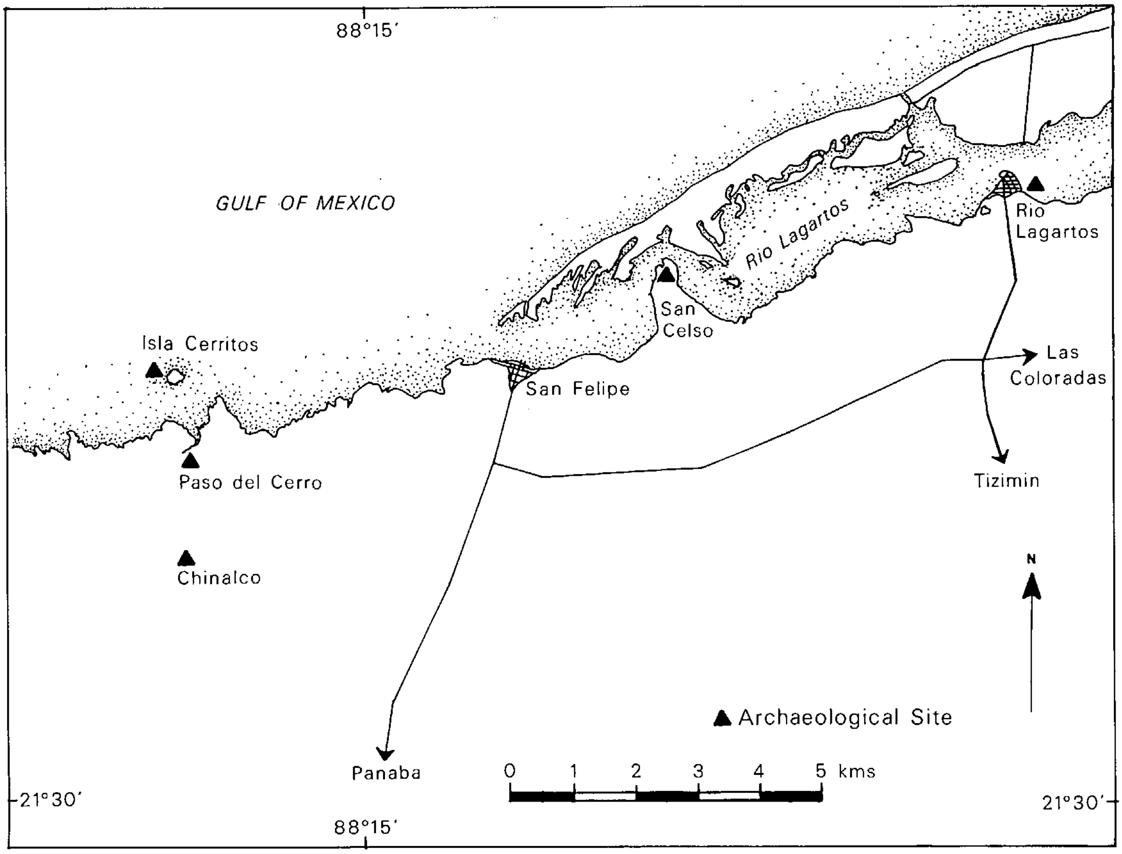

Table 1. Average elemental abundances and ratios of obsidian samples from Isla Cerritos, by x-ray fluorescence.

Provenience	*No. of samples*	*Ba, ppm**	*Zr, ppm**	*Rb/Zr*	*Sr/Zr*
El Chayal, Guatemala	9	953 ± 45†	134	1.24 ± .03	1.28 ± .03
Reference source‡		915 ± 35§	117	1.24 ± .04	1.29 ± .04
Ucareo, Michoacán	18	162 ± 29	153	1.18 ± .07	.12 ± .02
Reference source**		144 ± 9	130	1.18 ± .06	.09 ± .02
Ixtepeque, Jutiapa	2	1159 ± 50	199	.51 ± .02	.86 ± .01
Reference source††		1030 ± 27§	176	.57 ± .01	.90 ± .02
Zaragoza, Puebla	3	494 ± 26	244	.66 ± .01	.15 ± .01
Reference source‡‡		501 ± 9§	216	.68 ± .03	.15 ± .01
Pico de Orizaba, Mexico	1	801	77	2.03 ± .14	.55 ± .06
Reference source§§		751 ± 15§	58	2.04 ± .22	.49 ± .05
Unknown	1	55	262	.75 ± .02	.03 ± .01

* Measurements on artifacts are non-destructive and may give abundances that are too large because of sample shape effects. For ratios of abundances, however, this error cancels out to a large extent.

† Errors are RMSDs for groups, and estimated counting errors for single samples.

‡ These are our best reference values for El Chayal *source* obsidian. The best values for a large reference group including artifacts are 1.27 and 1.31 for Rb/Zr and Sr/Zr ratios, respectively (Stross et al. 1983: 339).

§ NAA best value.

** Data based on one sample provided by Fred Nelson.

†† Stross et al. 1983: 332, 339.

‡‡ Unpublished data based on samples provided by Edward B. Sisson.

§§ Data based on samples provided by Terrance Stocker and Edward B. Sisson.

assignment to Zaragoza. The average difference for the 16 best-measured elements is 1.8%, which is also a good match. Sample CERT-21 was confirmed in its assignment to Ixtepeque. CERT-29 was assigned a provenience from Pico de Orizaba; the average difference between the 14 best-measured elements was 2.1%. Assignment for CERT-27 cannot be made at present, but further work in progress may resolve this question.

Thus, 26% of the artifacts came from El Chayal and 6% from Ixtepeque, both in Guatemala; in Mexico, 53% came for Ucareo, 9% from Zaragoza, and 3% from Pico de Orizaba. It is remarkable that two-thirds of this suite of artifacts came from Mexican sources, more distant from the site than the Guatemalan sources represented.

A concordance of the sample designations is given in Table 3 to enable identification of the samples analyzed and presented in the tables.

Thirty-one additional samples of green obsidian were identified visually by members of the project as having come from Pachuca in the Central Mexican state of Hidalgo. This and another nearby locality, Tulancingo, have been identified as sources of this material (Spence and Parsons 1972; Charlton 1978). The vast majority of instrumentally sourced artifacts of this kind recovered from sites in the Maya Lowlands come from the Pachuca source (Nelson 1985); only a few have been reported from Tulancingo (Rice et al. 1985; Nelson 1985). As the artifacts from Isla Cerritos are of the translucent golden variety reported from Pachuca, rather than of the coarser variety reported from Tulancingo, we have tentatively assigned them a provenience of Pachuca.

Another source of green obsidian has been identified, but not located, in western Mexico (Stross et al. 1976). No artifacts outside this area have been traced to this source, and given its distance from the Maya Lowlands, we think it unlikely that any of the Isla Cerritos obsidian would have come from this area.

Thus, the 65 obsidian artifacts from Isla Cerritos can be traced to seven sources: 4 in Central Mexico, 2 in Guatemala, and 1 not yet located. The distribution of artifacts from each source (FIG. 1) is presented in Table 4, and a detailed distribution of the artifacts by period in Table 5.

Comparative Observations

From at least Middle Preclassic times (ca. 1000 B.C.) onward, communities in the Maya Lowlands imported obsidian from volcanic sources in the Guatemalan Highlands. This pattern continued in Late Preclassic times, with the exception of two sites, Tikal and Altun Ha, where

Table 2. Elemental abundances of obsidian samples from Isla Cerritos, by neutron activation analysis.

Sample	*Provenience*	*Ba**	*Ce*	*Co*	*Cs*	*Dy*	*Eu*	*Fe, %*	*Hf*	*K, %*	*La*
CERT-10	El Chayal	928±15	47.5± .8	.28±.06	7.54±.20	2.63±.09	.608±.011	.631±.016	3.47±.07	3.48±.28	25.9±1.5
CERT-17	El Chayal	894±15	46.7± .8	.19±.06	7.72±.20	2.67±.09	.586±.012	.638±.017	3.37±.07	3.78±.28	24.5±1.5
	El Chayal reference†	915±24	46.7± .9	.34±.13	7.65±.25	2.66±.11	.585±.011	.627±.027	3.27±.08	3.45±.26	24.6±1.0
CERT-3	Ucareo	182±10	72.4±1.1	.33±.04	6.93±.13	3.85±.07	.200±.008	.782±.013	4.29±.08	4.36±.22	37.3±1.8
CERT-9	Ucareo	168± 8	72.6±1.1	.41±.07	6.98±.14	3.89±.08	.202±.008	.776±.014	4.19±.09	4.38±.20	38.5±1.4
CERT-14	Ucareo	197± 8	76.1± .8	.40±.06	6.75±.19	3.72±.08	.229±.007	.788±.018	4.58±.06	4.29±.23	38.8±1.9
CERT-24	Ucareo	128± 8	67.1±1.0	.38±.06	7.23±.14	4.03±.09	.179±.007	.701±.013	4.15±.08	4.34±.23	34.8±1.3
CERT-25	Ucareo	153± 8	72.0±1.0	.34±.06	6.90±.13	3.73±.09	.184±.008	.783±.016	4.13±.08	4.18±.23	37.8±1.3
	Ucareo reference‡	166± 9	72.9± .8	.31±.04	6.89±.14	3.72±.08	.194±.007	.815±.016	4.24±.07	4.55±.23	37.5±1.3
CERT-19	Zaragoza	478±11	74.9±1.1	.71±.08	4.30±.10	4.83±.09	.451±.009	.981±.016	5.82±.10	4.25±.24	38.1±1.4
	Zaragoza reference§	501± 9	75.9± .9	.66±.06	4.26±.13	4.93±.10	.441±.009	.961±.020	5.83±.13	4.16±.12	40.1± .7
CERT-21	Ixtepeque	1048±17	44.3± .8	1.02±.08	2.67±.08	2.37±.10	.554±.016	.960±.016	4.59±.08	3.83±.25	23.7±1.0
	Ixtepeque reference**	1030±27	43.4± .9	1.05±.08	2.71±.17	2.30±.11	.541±.012	.923±.019	4.44±.12	3.61±.28	23.5± .9
CERT-29	Pico de Orizaba	746±17	14.3± .5	.17±.05	4.13±.09	1.98±.11	.226±.008	.364±.009	2.39±.06	3.73±.25	6.58±.75
	Pico de Orizaba reference††	751±15	14.9± .3	.12±.03	4.21±.15	1.94±.05	.226±.004	.373±.005	2.38±.10		5.88±.50
CERT-27	Unknown	51±14	113±1	.36±.07	5.77±.13	8.00±.12	.212±.009	.905±.015	7.62±.12	4.17±.25	56.0±1.8

		Mn	*Na, %*	*Rb*	*Sb*	*Sc*	*Sm*	*Ta*	*Th*	*U*	*Yb‡‡*
CERT-10	El Chayal	653±13	3.24±.06	155±7	.75±.08	1.87±.02	3.03±.03	.98±.01	10.4±.1	4.36±.07	2.10±.04
CERT-17	El Chayal	641±13	3.18±.06	160±7	.56±.07	1.89±.02	3.04±.03	.96±.01	10.4±.1	4.25±.07	2.09±.04
	El Chayal reference†	649±13	3.15±.06	149±8	.74±.11	1.85±.05	3.03±.03	.93±.02	10.4±.2	4.33±.07	2.03±.05
CERT-3	Ucareo	172± 3	2.87±.06	166±8	.48±.07	2.69±.03	4.58±.05	1.14±.01	14.7±.2	3.78±.07	2.54±.05
CERT-9	Ucareo	165± 3	2.81±.06	152±7	.46±.07	2.71±.03	4.52±.05	1.15±.01	14.7±.2	3.81±.07	2.52±.05
CERT-14	Ucareo	168± 3	2.81±.06	164±8	.38±.06	2.72±.03	4.58±.05	1.15±.01	14.7±.2	3.77±.07	2.48±.03
CERT-24	Ucareo	168± 3	2.89±.06	164±8	.39±.06	2.70±.03	4.42±.04	1.18±.01	14.8±.2	3.95±.07	2.58±.04
CERT-25	Ucareo	161± 3	2.78±.06	154±7	.40±.06	2.66±.03	4.50±.05	1.12±.01	14.6±.2	3.83±.07	2.46±.04
	Ucareo reference‡	165± 3	2.93±.06	155±6	.44±.05	2.74±.03	4.58±.05	1.12±.01	15.0±.2	3.85±.04	2.44±.03
CERT-19	Zaragoza	256± 5	3.04±.06	147±7	.35±.07	3.10±.03	4.83±.05	1.48±.02	20.4±.2	4.96±.08	3.69±.06
	Zaragoza reference§	252± 5	3.05±.06	133±7		3.09±.04	4.93±.05	1.46±.06	20.7±.3	5.09±.05	3.61±.04
CERT-21	Ixtepeque	442± 9	2.99±.06	112±6	.16±.05	2.07±.02	2.67±.03	.77±.01	7.18±.07	2.26±.05	2.00±.04
	Ixtepeque reference**	449± 9	3.05±.08	103±6	.19±.04	2.11±.05	2.65±.03	.76±.02	7.17±.10	2.30±.05	1.91±.04
CERT-29	Pico de Orizaba	547±11	3.19±.06	120±6	.32±.06	2.01±.02	1.56±.02	.89±.01	6.79±.07	4.18±.07	1.34±.03
	Pico de Orizaba reference††	554±11	3.22±.06	108±5		1.97±.02	1.57±.02	.87±.02	6.59±.11	4.19±.04	1.34±.05
CERT-27	Unknown	359± 7	3.03±.06	179±8	1.2±.1	2.65±.03	7.52±.08	2.91±.03	18.2±.2	5.07±.08	5.94±.08

* Abundances are in ppm except where otherwise indicated and errors are either 1 σ counting error for single sample or RMSD for group.

† These are our best reference values for El Chayal *source* obsidian. The best values for a large reference group including artifacts are 1.27 and 1.31 for Rb/Zr and Sr/Zr ratios, respectively (Stross et al. 1983: 339).

‡ Ucareo reference is an artifact attributed to an Ucareo source (Stross et al. 1978). Subsequent analyses show the source to be somewhat heterogeneous, especially the Ba, La, Ce, and Eu abundances.

§ Unpublished data based on samples provided by Edward B. Sisson.

** See Asaro et al. 1978: 437. For Ba value see Stross et al. 1983: 332.

†† Data based on samples provided by Terrance Stocker and Edward B. Sisson.

‡‡ Published values were revised upward by a factor of 1.056 after recalibration of the standard "Standard Pottery."

artifacts of green obsidian from Pachuca have been recovered. During the following Classic and Postclassic periods, the Guatemalan obsidian trade continued to dominate, although significant quantities of obsidian from Central Mexico also began to appear at sites throughout the Lowlands (Nelson 1985).

The present sample represents an anomaly in that 82% of it came from Central Mexican sources, of which Pachuca was the largest single one. This was the most common source of Mexican obsidian found in the Lowlands, and has been reported at over 25 sites. The largest collections are from Tikal (more than 550 artifacts, mostly from Early Classic contexts [Moholy-Nagy, Asaro, and Stross 1984]); from a Proto-Classic offering at Altun Ha, Belize (258 artifacts [Pendergast 1971]); and from two Late Postclassic/Protohistoric grave lots from Atasta, Campeche (45 artifacts [Ball and Rovner 1972]). Samples from other sites range between 1 to 20 artifacts, but usually include only one or two (Nelson 1985).

Irwin Rovner (1975: 107–108) has noted that the appearance of high frequencies of Central Mexican green obsidian at Maya sites coincides with the emergence of powerful polities in the area, and that these increases or "pulses" in the obsidian trade reflect times of intensive activity by Central Plateau groups in the Maya Lowlands. The large Early Classic samples form Tikal and Altun Ha are related to Maya interaction with Teotihuacán, while the samples from Atasta can be related to the presence of Aztec merchants at nearby Xicalango. Rovner has also posited that the undated green obsidian from Chichén Itzá is likely of Early Postclassic date, thus reflecting ties with the Toltec capital of Tula in Central Mexico (Ball and Rovner 1972: 42–43; Rovner 1975: 107–108). As is argued below, the Isla Cerritos sample reinforces the evidence for a major "pulse" in Early Postclassic times.

The other Mexican sources represented at Isla Cerritos are extremely rare in other Lowland samples. Our second largest source, Ucareo, is represented by 18 artifacts; the only other Ucareo artifacts reported from the Lowlands are 5 specimens from Classic period contexts at Tikal, El Mirador, and Lubaantun (Nelson 1985; Nelson and Howard 1986) and 2 bead fragments from Chichén Itzá (Moholy-Nagy and Ladd in press). Another 6 obsidian artifacts from Zinapécuaro, Michoacán, a source in the immediate vicinity of Ucareo, have been reported from Late Classic and Postclassic contexts at five Lowland sites, however (Nelson 1985; Nelson and Howard 1986). The rest of our Mexican sample came from Zaragoza, Puebla (3 artifacts), and Pico de Orizaba, Veracruz (1 artifact). Zaragoza obsidian is represented in the Maya Lowlands by 13 artifacts from Classic period contexts at five sites (Nelson 1985; Nelson and Howard 1986). Only two pieces of Pico de Orizaba obsidian have been reported from the Maya Lowlands: an undated artifact from Chicanna, Campeche, cited in a 1981 conference paper by Irwin Rovner, and a Postclassic item from Santa Rita, Belize (Nelson 1985).

The balance of our sample (17%) came from the Guatemalan Highland sources of El Chayal and Ixtepeque. Once again, our sample is an anomaly, as most of our Postclassic Guatemalan material came from the former locality. In other Lowland samples, El Chayal obsidian was the dominant source for the Classic period, while Ixtepeque obsidian is more common in Postclassic collections (Rice et al. 1985; Nelson 1985). While our sample is too small to be statistically representative, it is possible that it may reflect Itzá ties to the west coast and the Usumacinta River basin, which was a major corridor for the trade of El Chayal obsidian (Hammond 1972). In other words, most of the Guatemalan obsidian may have been coming to Isla Cerritos via this corridor, rather than by way of the east coast where Ixtepeque obsidian is predominant in Postclassic samples (Hammond 1972; Nelson 1985). Moreover, it is worth noting that the reported samples of Postclassic Maya Lowland obsidian are all from the eastern Guatemalan Petén or the east coast of Belize and Yucatán; with the exception of the sample of Pachuca obsidian from Atasta mentioned earlier, no Postclassic samples have been reported from the western side of the peninsula. As the east coast represents a logical corridor for the Ixtepeque trade, it is possible that reported Postclassic samples are geographically biased towards the Ixtepeque source; future Postclassic samples from the western and NW Lowlands may reveal a higher incidence of El Chayal obsidian.

Isla Cerritos, Chichén Itzá, and Tula

The source analysis of the obsidian from Isla Cerritos adds further corroboration to the notion that the island

Table 3. Concordance of sample designations.

Lawrence Berkeley Laboratory designation			*Archaeological context*
Sample number	*XRF*	*NAA*	
CERT-1	8148-E		IC-3-2
CERT-2	8148-F		IC-5-1
CERT-3	8148-G	2233-E	IC-17-1
CERT-4	8148-H		IC-35-3
CERT-5	8148-I		IC-35-3
CERT-6	8148-J		IC-35-3
CERT-7	8148-K		IC-35-3
CERT-8	8148-L		IC-35-3
CERT-9	8148-M	2233-F	IC-35-3
CERT-10	8148-N	2233-G	IC-35-3
CERT-11	8148-O		IC-35-3
CERT-12	8148-P		IC-36-1
CERT-13	8148-Q		IC-36-1
CERT-14	8148-R	2233-H	IC-36-1
CERT-15	8148-S		IC-47-1
CERT-16	8148-T		IC-47-1
CERT-17	8148-U	2233-J	IC-47-1
CERT-18	8148-V		IC-49-2
CERT-19	8148-W	2233-K	IC-50-4
CERT-20	8148-X		IC-61A-1
CERT-21	8148-Y	2233-M	IC-66-1
CERT-22	8148-Z		IC-113-4
CERT-23	8148-1		IC-114-1
CERT-24	8148-2		IC-114-1
CERT-25	8148-3	2233-O	IC-114-1
CERT-26	8148-4		IC-151-4
CERT-27	8148-5	2233-P	IC-151-6
CERT-28	8148-6		IC-154-1
CERT-29	8148-7	2233-Q	IC-154-2
CERT-30	8148-8		IC-154-4
CERT-31	8148-9		IC-155-1
CERT-32	8148-+		IC-168-1
CERT-33	8148- –		IC-173-1
CERT-34	8148-*		IC-175-2

Table 4. Provenience analysis of obsidian from Isla Cerritos. The obsidian samples from Pachuca were identified visually by project members by their translucent quality and green color (see text for a discussion of other green obsidian sources). The provenience analysis of the black grey samples from all other sources was undertaken by Frank Asaro, Helen Michel, and Fred Stross of the Lawrence Berkeley Laboratory, Berkeley, California. Percentages of total sample is shown in parentheses.

Source	*No. of artifacts*
Pachuca, Hidalgo	31 (48)
Ucareo, Michoacán	18 (28)
El Chayal, Guatemala	9 (14)
Zaragoza, Puebla	3 (5)
Ixtepeque, Guatemala	2 (3)
Pico de Orizaba, Veracruz	1 (1)
Unknown source	1 (1)

served as the main port of Chichén Itzá. In fact, the predominance of Central Mexican obsidian in the sample does not come as a surprise, given the extensive documentation of ties between the Itzá capital and Central Mexico during Terminal Classic and Early Postclassic times.

Thus far, only 6 obsidian artifacts from undated contexts at Chichén Itzá have been submitted for provenience analysis. Two pieces proved to have come from Pachuca, 1 from Otumba, 1 from Zinapécuaro, and 2 from Ucareo (Stross et al. 1968; Nelson et al. 1977; Nelson 1985; Moholy-Nagy and Ladd in press). In addition, more than 20 artifacts of green obsidian have been reported from the Cenote collections and Carnegie excavations (Proskouriakoff 1962). All of these materials are from undated contexts. Until there are more obsidian-analysis data from Chichén Itzá, the sample from Isla Cerritos can be taken as an indirect approximation of the Itzá obsidian trade networks.

As we have seen, 82% of the Isla Cerritos sample comes from Central Mexico, mostly from Pachuca and Ucareo, and 17% from Highland Guatemala. This source locality pattern has few parallels in the Maya area, where the bulk of obsidian from individual sites derived from sources in the Guatemalan Highlands. In fact, the distribution pattern closely resembles that of Tula, Hidalgo, which received most of its obsidian from Pachuca and Zinapécuaro during the Tollan Phase (ca. A.C. 900–1200; Hester, Jack, and Benfer 1973; Diehl 1981: 288; Healan, Kerley, and Bey 1983: 137). It is most likely that Tula controlled the Pachuca source (but see Healan 1986: 149–151); it also may have controlled the distribution of Zinapécuaro obsidian (Diehl 1981: 290). Since the Ucareo source lies in the immediate vicinity of Zinapécuaro, it may have been similarly controlled.

As most of our sample comes from Terminal Classic and Early Postclassic deposits, it provides a rough outline of the main avenues of the Itzá obsidian trade. In fact, it would appear that Isla Cerritos, and by extension, Chichén Itzá, were primarily connected to the obsidian trade networks of Central Mexico rather than to those of the Guatemalan Highlands. This reflects a clear break with the traditional obsidian trade networks of the Maya Lowlands, which had previously been dominated by the Guatemalan obsidian trade. As the Central Mexican network appears to have been controlled by Tula during this time, the results of the analysis clearly indicate that the Itzá maintained regular commercial ties with the Toltecs. This trade was most likely channelled through a series of outposts stretching down the north and west coasts of Yucatán to the Gulf Coast (Andrews 1978; Andrews and Robles Castellanos 1985). After the fall of Chichén Itzá, ca. A.C. 1200, this trade network collapsed, and obsidian trade from the Guatemalan Highlands became dominant again.

Table 5. Provenience of 65 obsidian artifacts from Isla Cerritos by period. Percentages are in parentheses.

Period and provenience	*No. of artifacts*
Late Preclassic period (Xaumito, ca. 100 B.C.–A.C. 400) (N = 1; 1.5%)	
Zaragoza, Puebla	1
Terminal Classic period (Chacpel, ca. A.C. 750–900) (N = 1; 1.5%)	
Ixtepeque, Guatemala	1
Terminal Classic/Early Postclassic periods (Chacpel/Jotuto, ca. A.C. 750–1200) (N = 14; 21.5%)	
Ucareo, Michoacán	7 (50)
Pachuca, Hidalgo	4 (29)
Chayal, Guatemala	2 (14)
Pico de Orizaba, Veracruz	1 (7)
Early Postclassic period (Jotuto, ca. A.C. 900–1200) (N = 40; 61.5%)	
Pachuca, Hidalgo	18 (45)
Ucareo, Michoacán	11 (28)
Chayal, Guatemala	7 (18)
Zaragoza, Puebla	2 (5)
Ixtepeque, Guatemala	1 (3)
Unknown source	1 (3)
Undefined period (Isla Cerritos and Paso del Cerro) (N = 9; 14%)	
Pachuca, Hidalgo	9

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Maya Maritime Trade and Sources of Obsidian at San Juan, Ambergris Cay, Belize

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San Juan is a small Late and Terminal Classic transshipment point on the north end of Ambergris Cay, Belize. It was well situated to have participated in the Maya maritime trade network that served large population centers on Corozal and Chetumal bays and those communities linked to these bays by the New River and Rio Hondo. A sample of Terminal Classic obsidian was sourced using visual, x-ray fluoresence, and neutron activation techniques. Although the bulk of the obsidian derives from El Chayal in Guatemala, as is common during the Terminal Classic in northern Belize, an unusually large proportion comes from Mexican sources. Because of its strategic location, San Juan functioned as a funnel through which goods from the north passed before being dispersed into northern Belize.

Introduction

San Juan occupies a small peninsular extension of Ambergris Cay, Belize, jutting north on the leeward side of the cay (FIG. 1). Although Ambergris Cay has generally been considered an island, it is actually a peninsula separated from Quintana Roo, Mexico, by an ancient canal (Guderjan 1988). Excavations at the site were undertaken in 1986 by the Ambergris Cay Archaeological Project (Guderjan 1988; Guderjan, Garber, and Smith 1988, in press). The site covers approximately two acres and is sw